



# **RC414 Universal Optical Converter/Repeater User Manual**

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## 1. Cautions



Please read the following notices carefully before installing and using the device, Raisecom does not respond to any loss that caused by violating safety notice.



RC414 provides optical port, and there is visible and invisible laser radiation when open. Do not stare into the beam or view directly with optical instruments and if the optical port is not used please insert the plug.



RC414 is integrated device that has precise elements, please avoid violent shakes and impacts, and do not disassemble or maintain the device yourself. If it is required, please do it under the guide of our technical staff following in the steps of anti static. Please contact us if there is any need.



There must be grounding protection for the sake of safety; do not disassemble the device yourself, we regard it as you waiver your rights of repair guarantee.

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## 2. Overview

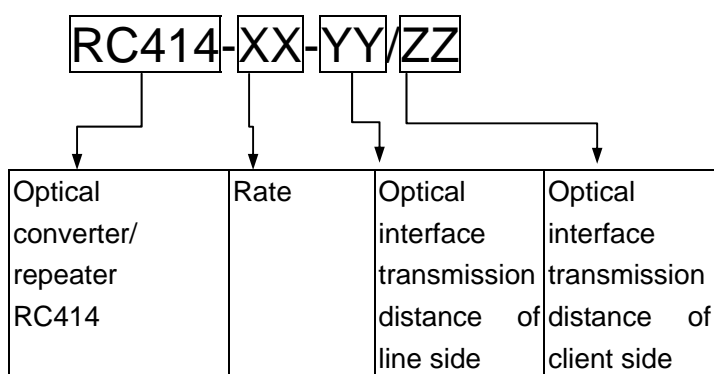
### 2.1. Introduction

A single RC414 converter is used to connect two devices which are between a long distance or operating with dissimilar optic fiber mode (e.g. single mode and multi mode). And RC414 provides 2R (reshape and reamplify) function for services within the rate range of 42Mbps- 2.5GMbps and provides 3R function for standard rate services (Gb, STM-4, STM-1 and FE).

### 2.2. Product features

- ◆ Multi rate: flexibly access fiber optic signals at rates of 1.25G or lower. Optical modules for different rates, different distances and different wavelengths are available for different customer needs, and you also can select relative optical connectors to achieve single/multi mode conversion.
- ◆ Transparently transmitting variable rate services: when you use high rate optical connector low rate services also can be transmitted (standard rate services of Gb, STM-4, STM-1, FE and other non-standard rate services are all included).
- ◆ Flexible debug function: provides fault pass through and fault return function on line side and client side for different customer needs.
- ◆ Retime function: a single RC414 converter has 3R function (Reshape, Reamplify and Retime), the low output jitter and client output jitter attenuating function can extending transmission distance.
- ◆ Loop back function: a single RC414 converter can provide bi-direction loop back function for system debug and device installation.

### 2.3. Ordering information



	C3:155M	M	M
	C12:622M	S1	S1
	Gb:1.25G	S2	S2
	C48:2.5G	S3	S3
		SS13	SS13
		SS15	SS15
		SS23*	SS23*
		SS25*	SS25*

\*note: optical connector type of SS23 and SS25 is only available at rate of C3.

For example: RC414-Gb-M/S1 is 1000M single mode to multi mode optical converter

RC414-C3-S2/S2 is 155M single mode to single mode optical converter/repeater.

### 3. Parameters

#### 3.1. Device specification

Dimension ( H*W*D )	91mm×25mm×170mm
Optical connector	SC/PC
Work temperature ( )	( 0, 45 )
Storage temperature ( )	( -40, 80 )
Power consumption ( W )	Typical value: 3.5W
Humidity	5%~90% non-condensing

#### 3.2. Optical interface specifications

◆ Optical interface index is in the following table, and these are EOL (End Of Value) value:

Rate Mbps	Type	Connector	Wave length nm	TX power dBm	Over load point dBm	Optical RX sensitivity dBm (BER=E-10)	Typical transmission distance Km	Optical loss dB/Km
FE/STM-1	M	DSC	1310	-18 ~ -14	-14	< -29	0 ~ 2	3
	S1	DSC	1310	-15 ~ -8	-8	< -34	0 ~ 25	0.5
	S2	DSC	1310	-5 ~ 0	-8	< -34	10 ~ 60	0.5
	S3	DSC	1550	-5 ~ 0(DFB)	-10	< -36	15 ~ 120	0.25

	SS13	SC	1310	-12 ~ -3	-8	< -30	0 ~ 25	0.5
	SS15	SC	1550	-12 ~ -3	-8	< -30	0 ~ 25	0.5
	SS23	SC	1310	-5 ~ 0	-8	< -32	10 ~ 50	0.5
	SS25	SC	1550	-5 ~ 0	-8	< -32	10 ~ 50	0.5
STM-4	M	DSC	850	-10 ~ -3	-3	< -17	0 ~ 0.55	3
	S1	DSC	1310	-10 ~ -3	-3	< -25	0 ~ 25	0.5
	S2	DSC	1550	-3 ~ +2(DF B)	-3	< -22	10 ~ 60	0.25
	S3	DSC	1550	-3 ~ +2(DF B)	-9	< -32(APD)	25 ~ 100	0.25
	SS13	SC	1310	-10 ~ -3	-3	<-22	0 ~ 20	0.5
	SS15	SC	1550	-10 ~ -3	-3	<-22	0 ~ 20	0.5
Gb	M	DSC	850	-10 ~ -3	-3	< -15	0 ~ 0.55	3
	S1	DSC	1310	-10 ~ -3	-3	< -23	0 ~ 25	0.5
	S2	DSC	1550	-3 ~ +2(DF B)	-3	< -20	10 ~ 60	0.25
	S3	DSC	1550	-3 ~ +2(DF B)	-9	< -30(APD)	25 ~ 100	0.25
	SS13	SC	1310	-10 ~ -3	-3	<-20	0 ~ 20	0.5
	SS15	SC	1550	-10 ~ -3	-3	<-20	0 ~ 20	0.5

◆ Jitter index

RC414 jitter value complies with ITU-T standard.

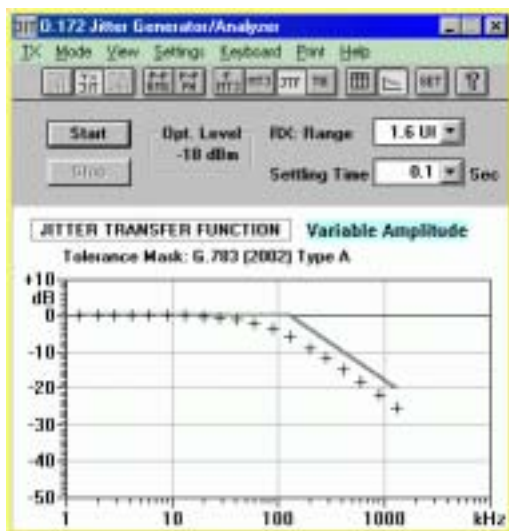
1 jitter value

STM level		ITU-T requirement	Typical value of RC414 <sup>1</sup>
STM-1 ( optical )	500Hz-1.3MHz	<0.30UI	0.050
	65KHz-1.3MHz	<0.10UI	0.030

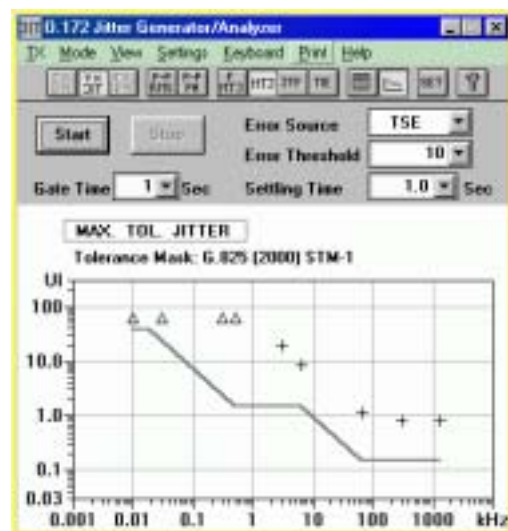
STM-4 ( optical )	1000Hz-5MHz	<0.30UI	0.004
	250KHz-5MHz	<0.10UI	0.004

1 NOTE: this is the average value of many times measure by ACTERNA ANT-20

2 jitter transfer and jitter tolerance



Typical figure of RC414 jitter transfer



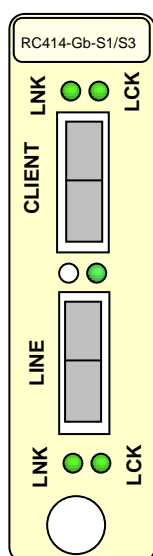
Typical figure of RC414 jitter tolerance

## 4. View and indicators

### 4.1. Dimensions

Dimension (H*W*D)	W*L*H:91mm*25mm*170mm
Weight (package is not included)	

### 4.2. Front view



Panel mesh print and interfaces are as above figure, the optical connector type is 1\*9.

LED indications:

LED	Color	Indication
PWR	Green	(power) ON: indicates power supply functioning normally; OFF: indicate power supply functioning abnormally or invalid.
LNK	Green	(link) ON: indicates there is a valid link; OFF: indicates there is no input signal. LNK of client side ON: indicates there is input signal of client side; OFF: indicates there is no input signal of client side. LNK of line side ON: indicates there is input signal of line side; OFF: indicates there is no input signal of line side.
LCK	Green	(lock) ON: indicates signal is locked; OFF: indicates signal is loss of lock. LCK of client side ON: indicates signal of RX channel (CLIENT->LINE) is locked; OFF: indicates signal of RX channel (CLIENT->LINE) is loss of lock. LCK of line side ON: indicates signal of TX channel

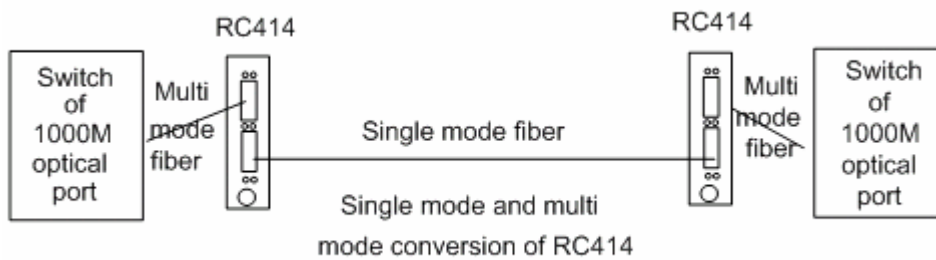


		(LINE->CLIENT) is locked; OFF: indicates signal of TX channel (LINE->CLIENT) is loss of lock.
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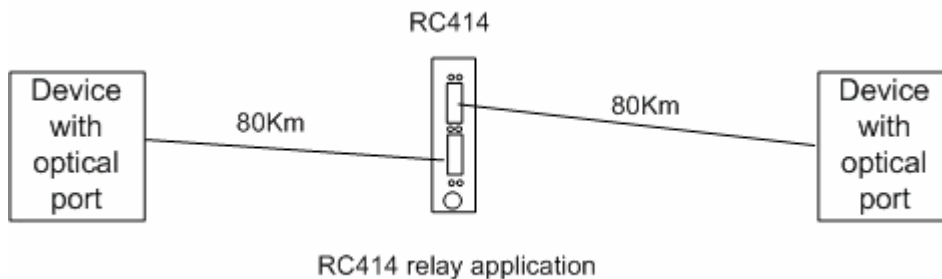
## 5. Functionality & Application

### 5.1. Typical application

i interconnect optical devices to convert fiber type from single mode to multi mode and extend transmission distance.



ii RC414 Provides OEO relay function to extend transmission distance.



RC414 can provide longer transmission distance through multilevel cascades. The cascade devices number of RC414 is not limited in theory. And we do the test uses 16 RC414 converters to cascade and we promise cascade 16 or fewer RC414.

## 6. Installation & Preparation

### 6.1. Installation

Slide RC414 into two adjacent installation slots and connect the fiber cable. If client side device and line side fiber are connected normally RC414 indicators LNK and LCK will be steady ON status. When install the device please be attention:

- 1 The connection sequence of fiber cables is not specified, but to satisfy the requirement of rate auto-sensing of single module (default setting enables rate auto-sensing), we recommend connect RX of client side fiber first (rate auto-sensing functioning normally when RX fiber of client side connects correctly).
- 2 Avoid Rx power of optical port is too high. Please do not connect optical port output with optical port input without attenuator, this may result in abnormal work of optical port or even damage it. Optical module of different rate and different transmission distance has different optical saturation power, usually optical power less than -8dBm will satisfy all the optical connectors.
- 3 Please set the rate of Ethernet services manually. In some peculiar case FE service may be regarded as GE service when use GE connectors, and in this condition there may be packet loss even if service connection is valid.

### 6.2. DIP switches configuration

RC414 has 4 banks of DIP switches (SW1 is 4-bit switches and SW2-SW4 are 8-bit switches). SW1 is fault pass through and fault return function configuration switch, SW2 is CDR configuration switch, SW3 is line side optical port information switch and SW4 is client side optical port information switch.

The entire DIP switches configuration is the module initialization configuration. And network management configuration has higher privilege than that of DIP switches except configuring loop back function.

SW1 function table ( fault pass through and fault return function )

Switch	Status	Function	Mesh print	Description	Privilege
SW1.1	On	Fault-pass Line to Client	FP_LC	Fault pass through from line side to client side. Optical TX of client side will shutdown if there is no RX signal of line side.	Network management configuration has higher privilege. This DIP switches configuration is valid when there is no network management. And when there is network management , network management configuration will be valid.
	Off	Normal	Normal	Normal.	
SW1.2	On	Fault-pass Client to Line	FP_CL	Faults pass through from client side to line side. Optical TX of line side will shutdown if there is no RX signal of client side.	
	Off	Normal	Normal	Normal.	
SW1.3	On	Fault-Return Line	FR_L	Fault return of line side. Line side TX of will shutdown if there is no RX signal. When pair uses RC414 this function is not allowed to enable at the same time by both ends.	
	Off	Normal	Normal	Normal.	
SW1.4	On	Fault-Return Client	FR_C	Fault return of client side. Client side TX of will shutdown if there is no RX signal. When pair uses RC414 this function is no allowed to enable at the same time by both ends.	
	Off	Normal	Normal	Normal.	

SW2 function table ( CDR configuration DIP switches )

Switch	Status	Function	Description	Privilege
SW2.1		Reserved	Reserved	
SW2.2	On	Line Loop	Line side loop back (forced)	Force to set loop back and has higher privilege than network Management.
	Off	Normal	Normal. Then module can be configured through network management and the default status is normal.	
SW2.3	On	Client Loop	Client side loop back (forced)	Force to set loop back and has higher privilege than network Management.
	Off	Normal	Normal. Then module can be configured through network management and the default status is normal.	

SW2.4	On	CDR_Disable	Disable CDR, in this condition the module has 2R function.	Network management configuration has higher privilege.
	Off	CDR_Enable	Enable CDR.	
SW2.5	On	Manual	Set rate manually according to SW2.6-8.	Network management configuration has higher privilege.
	Off	Auto	Controlled by CPU. When LOS indicator is off, RC414 will set CDR rate automatically from STM-16 to FE to accommodate the access data rate until there is no LOL (this indicates the module has locked that rate).	
SW2.6	2.6	Data rate	These three bits are valid when SW2.5 is on.	
SW2.7	2.7			
SW2.8	2.8			
	Off Off Off			
	Off Off On			
	Off On Off			
	Off On On			
	On Off Off			
	Other status	Reserved		

## Line side information switches SW3

Switch		Status (N: on, F: off)	Description
SW3.1-3.2	Rate	FF	155M
		FN	622M
		NF	1.25G
		NN	2.5G(reserved)
SW3.3-3.5	Reserved		Reserved
SW3.6-3.8	Distance	NNN	M
		NNF	S1
		NFN	S2
		NFF	S3
		FNN	SS13
		FNF	SS15
		FFN	SS23
		FFF	SS35

## Client side information switches SW4

Switch		Status (N: on, F: off)	Description
SW4.1-4.2	Rate	FF	155M
		FN	622M

		NF	1.25G
		NN	2.5G(reserved)
SW4.3-4.5	Reserved		Reserved
SW4.6-4.8	Distance	NNN	M
		NNF	S1
		NFN	S2
		NFF	S3
		FNN	SS13
		FNF	SS15
		FFN	SS23
		FFF	SS25

Default settings of SW1 and SW2 are OFF: fault pass through and fault return disable, loop back disable, CDR enable and rate auto-sensing enable.

SW3 and SW4 stand for optical connector information and cannot be set by users.

## 7. Network management

RC414 can be controlled, configured and inquired through Raisecom network management system (EMS version is 1.15 build 2 or higher).

### 7.1. Show module

Use "Show module" to inquire RC414 status information:

Number	Status name, items can be controlled and configured	Value	Control and configure features
1	Module type	C3, C12, GB M, S1, S2, S3, SS15, SS13, SS25 and etc.	Can be inquired but not configurable
2	Fault pass through from line side to client side	Enable & Disable	Can be inquired and configurable
3	Fault pass through from client side to line side	Enable & Disable	Can be inquired and configurable
4	Fault return of line side	Enable & Disable	Can be inquired and configurable
5	Fault return of client side	Enable & Disable	Can be inquired and configurable
6	Optical port of line side: LNK status	Up & Down	Can be inquired and configurable
7	Optical port of client side: LNK status	Up & Down	Can be inquired and configurable
8	Optical port of line side: LCK status	Loss Of LOCK & LOCK	Can be inquired and configurable
9	Optical port of client side: LCK status	Loss Of LOCK & LOCK	Can be inquired and configurable
10	CDR work status	Enable & Disable	Can be inquired and configurable
11	CDR rate	GE/GB, STM4, STM1, FE and N/A	Can be inquired and configurable

### 7.2. Configure module

The configurable items can be configured through "Config module" in above table and these items include fault debug configuration and CDR configuration. Fault debug includes: fault pass through from line side to client side, fault pass through from client side to line side, line side fault return, client side fault return and etc; CDR configuration includes: enable or disable CDR and set the CDR rate as auto-sensing or forced rate.

### 7.3. Module reset and loop back detection

Host-site module can be reset through “Reset module” command. After reboot, the working mode and status will remain the same as that before reboot.

Use “loop config” to set loop back of line side or client side for debug and installation.



## 8. Q & A

	Fault	Resolve
1	LNK indicator off	Check the input power of relative optical port.
2	Client LNK on, and LCK off	<p>1 check the input signal of client side.</p> <p>2 check the optical RX power of client side.</p> <p>3 if rate auto-sensing enables please change it to manual configuration mode through switches SW2.5 and set the rate through SW2.6-8.</p> <p>4 if above steps still cannot resolve the problem, use SW2.4 to disable CDR.</p> <p>5 contact technical staff of RAISECOM</p>
3	Client LNK and LCK on Line LNK on and LCK off	<p>1 check whether client side data and line side data is at same rate.</p> <p>2 check optical power of optical port.</p> <p>3 if rate auto-sensing enables please change it to manual configuration mode through switches SW2.5 and set the rate through SW2.6-8.</p> <p>4 if above steps still cannot resolve the problem, use SW2.4 to disable CDR.</p> <p>5 contact technical staff of RAISECOM</p>
4	Rate auto-sensing failed but manual configuration normal	Check optical interface information switches. There is the possibility that optical connector is 1000M but the input data rate is 100M. And set the rate manually.
5	Disconnect sometimes and there is packet loss	Check the optical power of all optical ports first and if the power consumption value is normal set the rate manually.
6	Network management is not available	Make sure that EMS version is 1.15 (build 4) or higher and MCU chip (U7) is tightly contacted with pad.

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